Subt F'

1. An imaging device comprising:

a substrate;

a photosensitive area within said substrate for accumulating photo-generated charge in said area;

a photogate for controlling the accumulation of photo-generated charge in said photosensitive area; and

a nitrogen containing insulating layer over said substrate and beneath said photogate.

Sub I'

2. The imaging device according to claim 1, wherein said photogate includes a doped polysilicon deposited over said insulating layer.

3. The imaging device according to claim 1, wherein said photogate includes a transparent or semi-transparent conductor deposited over said insulating layer.

4. The imaging device according to claim 3, wherein said transparent or semi-transparent conductor is selected from the group consisting of indium-tin-oxide, tin oxide, indium oxide and doped hydrogenated amorphous silicon .

5. The imaging device according to claim 1, wherein said nitrogen containing insulating layer is grown over said substrate.

6. The imaging device according to claim 1, wherein said nitrogen containing insulating layer is deposited over said substrate.

7. The imaging device according to claim 1, wherein said nitrogen containing insulating layer is a silicon nitride layer.

Sub I'

8. The imaging device according to claim 1, said nitrogen containing insulating layer is a nitrogen oxide containing layer.

9. The imaging device according to claim 8, wherein said nitrogen containing insulating layer is ONO.

10. The imaging device according to claim 8, wherein said nitrogen containing insulating layer is NO.

11. The imaging device according to claim 8, wherein said nitrogen containing insulating layer is ON.

12. The imaging device according to claim 2, wherein said nitrogen containing insulating layer is a silicon nitride layer.

13. The imaging device according to claim 12, said nitrogen containing insulating layer is an ONO layer.

Subt F^2

14. An imaging device including a semiconductor integrated circuit substrate, said imaging device comprising:

a photosensitive device, including a photogate overlying said substrate, for accumulating photo-generated charge in a photosensitive area of said substrate;

a readout circuit comprising at least an output transistor formed in said substrate;

a reset transistor for periodically resetting a ~~said~~ node to a predetermined voltage; and

a nitrogen containing insulating material formed over said substrate and beneath said photogate.

Sub I^1

15. The imaging device according to claim 14, further comprising a charge transfer region for receiving charge from said photosensitive area having a control terminal, said transfer region being formed in said substrate adjacent said photosensitive area and having a node connected to a gate of said output transistor.

16. The imaging device according to claim 14, wherein said nitrogen containing insulating material is grown over said substrate.

17. The imaging device according to claim 14, wherein said nitrogen containing insulating material is deposited over said substrate.

18. The imaging device according to claim 15, further comprising at least one charge transfer device for transferring charge from said photosensitive area to said node in accordance with a control signal applied to said control terminal

Sub I'

19. The imaging device according to claim 14, wherein said nitrogen containing insulating material is a silicon nitride layer.

20. The imaging device according to claim 14, said nitrogen containing insulating material is a nitrogen oxide containing layer.

21. The imaging device according to claim 20, said nitrogen containing insulating material is an ONO layer.

22. The imaging device according to claim 20, said nitrogen containing insulating material is an NO layer.

23. The imaging device according to claim 20, said nitrogen containing insulating material is an ON layer.

24. The imaging device according to claim 14, wherein said nitrogen containing insulating material is deposited by chemical vapor deposition.

Sub I'

25. The imaging device according to claim 14, wherein said photogate includes a doped polysilicon deposited over said insulating layer.

26. The imaging device according to claim 14, wherein said photogate includes a transparent or semi-transparent conductor deposited over said insulating layer.

27. The imaging device according to claim 26, wherein said transparent or semi-transparent conductor is selected from the group consisting of indium-tin-oxide, tin oxide, indium oxide and doped hydrogenated amorphous silicon .

Subt F3

28. An imaging system comprising:

a plurality of active pixel sensors arranged in an array of rows and columns, each active pixel sensor being operable to generate a voltage at a diffusion node corresponding to detected light intensity by the sensor;

a photogate formed over a charge collection area in a substrate in said pixel sensor; wherein a nitrogen containing insulating layer is formed over said substrate and beneath said photogate;

a reset device to periodically reset the voltage of said diffusion node;

a row decoder having a plurality of control lines connected to the sensor array, each control line being connected to activate the sensors in a respective row; and

a plurality of output circuits, each output circuit being connected to the respective sensors in a column, operable to store voltage signals received from the sensors and to provide a sensor output signal.

Sub I'

29. The imaging system according to claim 28, further comprising a transfer transistor to transfer charge from said charge collection area to said diffusion node.

30. The imaging system according to claim 28, wherein said diffusion node is a floating diffusion node.

Sub I'

31. The imaging system according to claim 28, wherein said nitrogen containing insulating layer is grown over said substrate.

32. The imaging system according to claim 28, wherein said nitrogen containing insulating layer is deposited over said substrate.

33. The imaging system according to claim 28, wherein said nitrogen containing insulating layer is a silicon nitride layer.

Subt F4

34. The imaging device according to claim 28, wherein said nitrogen containing insulating layer is a nitrogen oxide containing layer.

35. The imaging device according to claim 34, wherein said nitrogen containing insulating layer is an ONO layer.

36. The imaging device according to claim 34, wherein said nitrogen containing insulating layer is an NO layer.

37. The imaging device according to claim 34, wherein said nitrogen containing insulating layer is an ON layer.

38. The imaging device according to claim 33, wherein said silicon nitride insulating layer is deposited by chemical vapor deposition.

39. An imaging system comprising:

a plurality of active pixel sensors arranged in an array of rows and columns, each active pixel sensor being operable to generate a voltage at a floating diffusion node corresponding to detected light intensity by the sensor;

b

in said pixel sensor

C

a photogate formed over a charge collection area in a substrate; wherein a nitrogen containing insulating layer is formed over said substrate and beneath said photogate;

a reset device to periodically reset the voltage of said diffusion node;

a row decoder having a plurality of control lines connected to the sensor array, each control line being connected to activate the sensors in a respective row; and

a plurality of output circuits, each output circuit being connected to the respective sensors in a column, operable to store voltage signals received from the sensors and to provide a sensor output signal.

40. The imaging system according to claim 39, wherein said diffusion node is a floating diffusion node.

Sub I7

41. The imaging system according to claim 39, wherein said nitrogen containing insulating layer is grown over said substrate.

42. The imaging system according to claim 39, wherein said nitrogen containing insulating layer is deposited over said substrate.

43. The imaging system according to claim 39, wherein said photogate includes a doped polysilicon deposited over said insulating layer.

44. The imaging system according to claim 39, wherein said photogate includes a transparent or semi-transparent conductor deposited over said insulating layer.

45. The imaging system according to claim 44, wherein said transparent or semi-transparent conductor is selected from the group consisting of indium-tin-oxide, tin oxide, indium oxide and doped hydrogenated amorphous silicon .

46. The imaging system according to claim 39, wherein said nitrogen containing insulating layer is a silicon nitride layer.

Subt F5

47. The imaging device according to claim 39, wherein said nitrogen containing insulating layer is a nitrogen oxide containing layer.

48. The imaging device according to claim 47, wherein said nitrogen containing insulating layer is an ONO layer.

49. The imaging device according to claim 47, wherein said nitrogen containing insulating layer is an NO layer.

50. The imaging device according to claim 47, wherein said nitrogen containing insulating layer is an ON layer.

51. The imaging device according to claim 46, wherein said silicon nitride insulating layer is deposited by chemical vapor deposition.

52. The imaging device according to claim 48, wherein said ONO insulating layer is deposited by chemical vapor deposition.

53. A system comprising:

(i) a processor for processing image data; and

(ii) a CMOS imaging device for providing image data to said processor and including:

a substrate;

a photosensitive area within said substrate for accumulating photo-generated charge in said area;

a photogate for controlling the accumulation of photo-generated charge in said photosensitive area; and

a nitrogen containing insulating layer over said substrate and beneath said photogate.

Sub I'

54. The imaging device according to claim 53, wherein said photogate includes a doped polysilicon deposited over said insulating layer.

55. The imaging device according to claim 53, wherein said photogate includes a transparent or semi-transparent conductor deposited over said insulating layer.

56. The imaging device according to claim 55, wherein said transparent or semi-transparent conductor is selected from the group consisting of indium-tin-oxide, tin oxide, indium oxide and doped hydrogenated amorphous silicon .

57. The imaging device according to claim 53, wherein said nitrogen containing insulating layer is grown over said substrate.

58. The imaging device according to claim 53, wherein said nitrogen containing insulating layer is deposited over said substrate.

59. The imaging device according to claim 53, wherein said nitrogen containing insulating layer is a silicon nitride layer.

60. The imaging device according to claim 53, said nitrogen containing insulating layer is a nitrogen oxide containing layer.

61. The imaging device according to claim 60, wherein said nitrogen containing insulating layer is ONO.

62. The imaging device according to claim 60, wherein said nitrogen containing insulating layer is NO.

63. The imaging device according to claim 60, wherein said nitrogen containing insulating layer is ON.

64. The imaging device according to claim 53, wherein said nitrogen containing insulating layer is a silicon nitride layer.

Sub I'

65. The imaging device according to claim 53, said nitrogen containing insulating layer is an ONO layer.

C
C

66. The system according to claim 53, wherein said system is a camera component ~~system~~.

67. The system according to claim 53, wherein said system is a scanner.

68. The system according to claim 53, wherein said system is a machine vision system.

69. The system according to claim 53, wherein said system is a vehicle navigation system.

70. The system according to claim 53, wherein said system is a video telephone system.

71. A method for fabricating a sensor cell of a CMOS imager, comprising the steps of:

forming a doped photo-collection region in a semiconductor substrate;

forming a first insulating layer over said substrate;

forming a first conductive layer over said first insulating layer;

removing at least a portion of said first conductive layer to form at least one transistor gate over said substrate;

forming a nitrogen containing insulating layer in contact with said first insulating layer; and

forming a second conductive layer atop said nitrogen containing insulating layer over said photo-collection region.

72. The method according to claim 71, wherein said first insulating layer is a silicon dioxide layer.

73. The method according to claim 71, wherein said first conductive layer is a doped polysilicon layer.

74. The method according to claim 71, wherein said doped polysilicon layer is deposited by chemical vapor deposition.

75. The method according to claim 71, wherein said first conductive layer is removed by etching.

76. The method according to claim 71, wherein said nitrogen containing insulating layer is a silicon nitride layer.

77. The method according to claim 71, wherein said nitrogen containing insulating layer is an ONO layer.

78. The method according to claim 71, wherein said nitrogen containing insulating layer is an NO layer.

79. The method according to claim 71, wherein said nitrogen containing insulating layer is an ON layer.

80. The method according to claim 78, wherein said silicon nitride layer is deposited by chemical vapor deposition.

81. The method according to claim 71, wherein said second conductive layer is a doped polysilicon layer.

82. The method according to claim 71, wherein said second conductive layer is a transparent or semi-transparent layer.

83. The method according to claim 82, wherein said second conductive layer is selected from the group consisting of indium-tin-oxide, tin oxide, indium oxide and doped hydrogenated amorphous silicon .

84. The method according to claim 81, wherein said second conductive layer of doped polysilicon is deposited by chemical vapor deposition.

85. The method according to claim 84, wherein said second conductive layer of doped polysilicon is patterned by selective etching.

86. The method according to claim 71, wherein said nitrogen containing insulating layer has a thickness of from about 20 to about 500 angstroms.

87. The method according to claim 86, wherein said nitrogen containing insulating layer has a thickness of from about 30 to about 100 angstroms.

88. The method according to claim 71, wherein said first insulating layer has a thickness of from about 20 to about 500 angstroms.

89. The method according to claim 71, wherein said second conductive layer is a doped polysilicon layer coated with a silicide layer.

90. A method for fabricating a sensor cell of a CMOS imager, comprising the steps of:

forming a doped photo-collection region in a semiconductor substrate;

forming a first insulating layer over said substrate;

forming a first conductive layer over said first insulating layer;

removing at least a portion of said first conductive layer adjacent said doped photo-collection region;

forming a nitrogen containing insulating layer in contact with said first insulating layer; and

forming a second conductive layer atop said nitrogen containing insulating layer over said photo-collection region.

91. The method according to claim 90, wherein said first insulating layer is a silicon dioxide layer.

92. The method according to claim 90, wherein said first conductive layer is a doped polysilicon layer.

93. The method according to claim 90, wherein said doped polysilicon layer is deposited by chemical vapor deposition.

94. The method according to claim 90, wherein said first conductive layer is removed by etching.

95. The method according to claim 90, wherein said nitrogen containing insulating layer is a silicon nitride layer.

96. The method according to claim 90, wherein said nitrogen containing insulating layer is an ONO layer.

97. The method according to claim 90, wherein said nitrogen containing insulating layer is an NO layer.

98. The method according to claim 90, wherein said nitrogen containing insulating layer is an ON layer.

99. The method according to claim 90, wherein said second conductive layer is a doped polysilicon layer.

100. The method according to claim 90, wherein said second conductive layer is a transparent or semi-transparent layer.

101. The method according to claim 100, wherein said second conductive layer is selected from the group consisting of indium-tin-oxide, tin oxide, indium oxide and doped hydrogenated amorphous silicon .

102. The method according to claim 90, wherein said second conductive layer of doped polysilicon is patterned by selective etching.

103. A method for fabricating a sensor cell of a CMOS imager, comprising the steps of:

forming a doped photo-collection region in a semiconductor substrate;

forming a nitrogen containing insulating layer over said doped photo-collection region; and

forming a photogate atop said nitrogen containing insulating layer.

104. The method according to claim 103, wherein said nitrogen containing insulating layer is a silicon nitride layer.

105. The method according to claim 103, wherein said nitrogen containing insulating layer is an ONO layer.

106. The method according to claim 103, wherein said nitrogen containing insulating layer is an NO layer.

107. The method according to claim 103, wherein said nitrogen containing insulating layer is an ON layer.

108. The method according to claim 104, wherein said silicon nitride layer is deposited by chemical vapor deposition.

109. The method according to claim 105, wherein said ONO layer is deposited by chemical vapor deposition.

110. The method according to claim 103, wherein said nitrogen containing insulating layer has a thickness of from about 20 to about 500 angstroms.

111. The method according to claim 110, wherein said nitrogen containing insulating layer has a thickness of from about 30 to about 100 angstroms.

112. The method according to claim 103, wherein said photogate is formed of a doped polysilicon.

113. The method according to claim 103, wherein said photogate is formed of a transparent or semi-transparent material.

114. The method according to claim 113, wherein said transparent or semi-transparent material is selected from the group consisting of indium-tin-oxide, tin oxide, indium oxide and doped hydrogenated amorphous silicon .

add B1

add C2

add D1